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NPIC/P&DS/D/6-1628
17 October 1966

MEMORANDUM FOR: Chairman, Project Evaluation Committee, P&DS

THROUGH: Chief, Development Branch

SUBJECT: X-Y Measuring Light Tables

REFERENCE: Project Suggestion Submitted [redacted] 25X
X1 [redacted] IAD and Project 02057

1. A need has been expressed by representatives of IAD for a device to simplify film coordinate readout. In addition to this requirement, the Development Branch has suggested as a part of our 67 program that an on-line measuring capability be incorporated into our new advanced light tables which currently have mechanical read-out capabilities. On the basis of these two related suggestions, a preliminary investigation was carried out to determine the feasibility of the project.

2. It was soon discovered that several systems already exist which can be modified to do either or both jobs. These existing systems are priced proportionally to the accuracy and sophistication of the equipment. For example, the [redacted] has a 25X
"Vernac" measuring system listed in its catalogue. The "Vernac" provides an accuracy of approximately 25 microns in both the X and Y axes. The readout is by dial which reads in thousandths of an inch.
X1 The price of the "Vernac" is [redacted] making the cost of the table, with a vacuum holddown and Vernac, total [redacted] Another measuring 25X
system which could be mounted on a light table is the [redacted] "Dig" 25X
system. The "Dig" system has an accuracy of approximately ±2 microns and can be readout on an electronic digital display. The "Dig" can also be directly linked with a computer and operated on-line. A two axis "Dig" system with dual data output and two display units
X1 would cost about [redacted] A light table with adequate support and holddown features would add an estimated [redacted] to the cost of the 25X
system. The "Dig" and the "Vernac" are both capable of measuring X and Y distances on film but the needs of the PI's will determine which, if any, system is appropriate.

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3. The needs of the PI's with regards to X-Y measuring systems, will vary. A system which would only be used for coordinate readout for ordering enlargements etc. would only need to be accurate to 1mm. However, a system which only provides a visual display -- which then must be recorded manually -- will not yield a significant time saving over the current system of overlaying the photo with a grid and reading the coordinates from the grid. Therefore, in order to be effective, a system used for coordinate readout would have to be sophisticated enough to provide a printed readout or to send the information through a data link to the Photo Lab where the information would then be printed out. A system of this type would still require the manual input of mission, frame, etc., information as well as the necessary ordering information for the Photo Lab. Thus a system for X-Y coordinate readout would require:

a. X-Y digital encoders mounted on a light table which would record the movement of a microscope to the nearest millimeter.

b. an electronic processing unit which would convert the encoded signal into a visual display as well as an acceptable output signal for transmitting to a remote station, e.g., computer photo lab etc.

c. a manual input station which would convert a human input into an electronic signal (teletype etc.)

d. an electronic processing unit which would convert the signals from both these inputs into a common format output (this task could be performed on the computer), and

e. a writing unit which would produce a hard copy target location or photo enlargement order.

4. The time savings to be realized by such a coordinate readout system are estimated to be about ¼ man-hour per order. The cost of the system, not including computer time, programming time, or installation costs, is estimated at [redacted] per input station. The output station cost is estimated at [redacted] A modified version of this system would require a central electronic processing unit and manual input unit for each room into which any of the modified light tables could be plugged. In this case, the central input processing station cost would be about [redacted] and each table would cost about [redacted] If 6000 lab orders per year were made on 50 light tables connected with 10 central processing units, all of which had an average 10 year life span, and if the aforementioned estimates are correct, it would cost [redacted] in equipment for each man-hour saved in writing and transmitting lab orders. It appears using people would be cheaper.

5. If the system mentioned previously had an accuracy of 5 microns or better, it could be used as a measuring system as well as a photo enlargement ordering device a great advantage. By trying each light table to the computer, a new mensuration capability would be available to the PI's. The next question is, "Do the PI's really need a capability for measuring more accurately than they can at present?" Many opinions both pro and con have been expressed on this question by PI's and members of the Development Branch. It is almost impossible to find an absolute answer to this question without setting up a test. A pilot operational system should be established to determine the cost effectiveness of providing fast, accurate, on-line, measuring light tables for the PI's in NPIC.

6. The proposed operational test system would give PI's the ability to measure distances to ±2 microns on the film and provide computed ground distances from the computer within seconds. If the proper program was formulated; the PI's could also order photo enlargements from the lab with the same system. The hardware would consist of the following:

a. Stable light tables with traversing microscope carriages and adequate holddown systems.

b. "Dig" scales mounted on the X and Y axis of light tables.

c. Removeable "Dig" reading heads which could be locked into proper position on any modified light table -- in this manner one set of reading heads would probably serve a PI group of 4 or 5 PI's.

d. Electronic consoles containing the necessary counters, buffer storage, synchronizers, control panels, and digital displays which would allow the PI to input digital information to the computer (one console would be required for each pair of reading heads), and

e. Teletype which would allow the PI to input auxiliary information to the computer and also provide an output for the computer (one teletype would be needed with each console and one of the Photo Lab).

7. The costs (not including installation or programming costs) of this on-line system are estimated to be as follows:

4 light tables	[redacted]	25X
4 sets of scales		
1 set reading heads		
1 console		
1 teletype		
Total		per PI Group *

* This is the estimated cost of an operational system -- not the test prototype.

These figures assume that only one PI in a group of four would need to measure or order prints at any one time. The actual savings in time cannot be accurately estimated without an operational test.

8. The proposed test would involve developing or modifying the necessary light table (already available) and mounting the "Dig" scales and heads. The electronic console could be made by combining the "Dig" electronics with [redacted] output and console, but this interfacing would be very complex and will require development. Further, a program would have to be written by IPD to permit sending orders for enlargements to the Photo Lab. In summary, two equipment development contracts and a Computer program are needed before an in-house operational test can be made of on-line measuring light tables.

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9. The Development Branch has already been assigned the task of developing the measuring light table as it was in the past assigned the tasks of developing the rear-projection reader/viewer and chip comparator. These other devices are currently in-house, but are seldom used because of certain inadequacies of the equipment, lack of needed programming, and lack of training of the interpreters. The measuring devices could be used most beneficially during the OAK, however the necessary ephemeral data is not available for use until after the OAK has been published. The normal program which would allow the preliminary ephemeral data to be used, will not be ready until the Spring or Summer of 1967. The program which will compute measurements of KH-7 photography will not be ready for a month or so either. When the PI realizes that the only photography he can measure on-line is the older KH-4 material (provided the ephemeral data has been loaded in the computer) and then he is shown the somewhat complex controls for the equipment and is told "If you want to use this, Joe will show you the ropes..", then it is no wonder the PI will be discouraged and revert to using a reticle and slide rule for "precise" measuring. With the proper computer programs available and with the proper training program, the measuring light table could be an extremely useful tool. Since the device would be the simplest and cheapest piece of on-line measuring equipment, it might be made available to each PI if the effectiveness justified the cost. In keeping with current Center policy, this pilot project should be undertaken. It should be noted, however, that the development costs of the pilot station could reach [redacted] and that unless the operational components of NPIC agree or are directed to cooperate fully with the testing, there is no point in proceeding with this program.

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Development Branch, P&DS

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